Genetics and Sports

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Preface

Athletic performance and the occurrence of sports-related injuries are both multifactorial conditions which are determined by the complex and poorly understood interactions of both environmental and genetic factors. Although much work has been done to identify the non-genetic components that are associated with performance and susceptibility to injuries, there is an ever growing body of research investigating the genetic contribution to these phenotypes. This book, which contains contributions by a broad range of scientist and clinicians from several disciplines – including, but not limited to, human molecular genetics, clinical genetics and exercise science – covers a number of topics in an attempt to obtain an integrated and holistic understanding of the field. The recent sequencing of the human genome and development of several tools and methodologies have successfully been used to investigate the genetic contribution to many complex diseases. This area of research has more recently been applied to the fields of exercise science and sports medicine. This publication reviews past, current and future applications, as well as the ethical concerns, of genetic research in the fields of exercise science and sports medicine.

The introductory chapter of this book highlights current and key concepts in human genetics, in particular with respect to its application to understanding multifactorial conditions. This is followed by a chapter exploring the often misunderstood relationship between nature (genetics) and nurture (common environmental effects such as training, diet, etc.) in determining athletic ability. The third chapter summarises the methodologies initially used during the pre-molecular biology era and the estimates obtained for gene and environmental contributions for performance-related phenotypes. The molecular genetics of performance is specifically investigated in the subsequent four chapters. These chapters include a review of the specific DNA sequence variants currently believed to be associated with athletic performance and response to training, critical reviews of the roles of the much investigated variants within the angiotensin-converting enzyme and α-actinin-3 genes and performance, and finally an exploration of the genetic and lifestyle of the East African runners who have dominated distance running events for the last half century.
This book also contains a chapter exploring the interaction of lifestyle, such as physical active or sedentary, with genetic make-up and its implications on human health, in particular understanding mechanisms underlying specific diseases, such as obesity, and its prevention. This is followed by a chapter summarising the recent developments in the identification of genetic risk factors for musculoskeletal soft tissue injuries.

The current and possible application of gene therapy as well as other novel therapeutic strategies such as stem cell and growth factor therapies in injured athletes is also reviewed. This is followed by a chapter exploring the potential abuse of genetic information and technologies, together with other developments in molecular biology, (gene doping) to enhance performance. The ethical framework in which genetic research is done and its application is not straightforward. Exercise scientists and sports physicians need to keep abreast of advances in medical ethics broadly and customise them efficiently to the field. These issues are discussed in the second last chapter, which is followed by a review on the new technologies and paradigms which will influence future genetic research in exercise science and sports medicine.

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